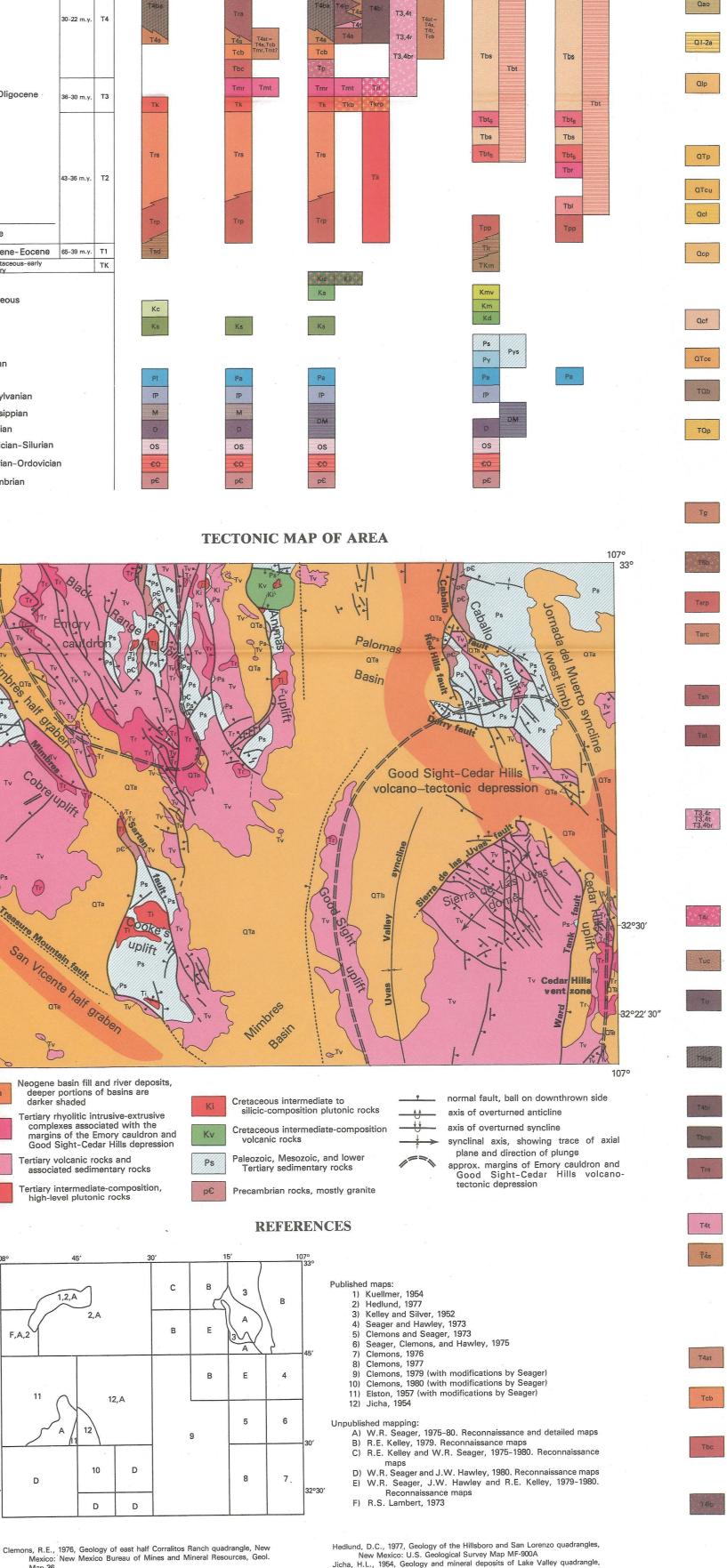


NEW MEXICO BUREAU OF MINES & MINERAL RESOURCES A DIVISION OF NEW MEXICO INSTITUTE OF MINING & TECHNOLOGY



CORRELATION OF ROCK UNITS

Ancestral Rio Grande drainage West of Good Sight Mountains

Closed-basin deposits

Mimbres and Rio Grande vallevs

Cobre uplift and

Mimbres Valley

hills adjacent to the Rio Grande; up to 100 ft thick Undifferentiated deposits—Qpy and Qpo Sierra de las Uvas Camp Rice Formation, undivided - Qcp and Qtcc Camp Rice Formation, fluvial facies — Gray to yellow sand, pebble to cobble gravel, (where most of the unit underlies 4.2 m.y.-old basalt flow Basalt flows — Black to dark-gray, vesicular flows of alkali olivine-basalt locally contain Santa Fe Group, Rincon Valley Formation, conglomerate facies—Red-brown sandstone derived from rhyolite domes of Cedar Hills vent zone; interlingers with basaltic-andesite flows and is a fan facies of the upper Thurman Formation of the Jvas Basaltic Andesite — Thin, black to medium-gray, vesicular basaltic-andesite and tains area; includes basaltic cinder beds and cone fragments as well as tongues of enaga Canyon Formation of Clemons (1979); up to 800 ft thick; 25.9 \pm 1.5 m.y. asaltic-andesite and other intermediate-composition flows-Dark- to inter-Bear Springs Basalt—Reddish-brown, brownish-black and black, vesicular to amygdaloidal basaltic-andesite flows; nonporphyritic; up to 1,000 ft thick in northbetween Hillsboro and Kingston and north of the middle fork of the Percha in the lack Range, the T4s map unit also includes brown, reddish-brown, and gray sand stone, fanglomerate, and rhyolitic tuffs that underlie and are interbedded with T4 fanglomerate fills broad valleys or canyons in older volcanic units in this area, and is largely derived from associated latite-porphyry flows (T4Ip); unit ranges from less Undifferentiated tuffs and sedimentary rocks-Includes thin tuffs and sedimentary rocks between the Kneeling Nun Tuff and Razorback Formation along the western edge of the Black Range and in the Mimbres Valley; generally correlative there with T4s, Tcb, Tbc and perhaps Tmr and Tmt Caballo Blanco Rhyolite Tuff - White to light-gray, brown-weathering, crystal-rich ash-flow tuff (compound cooling unit); phenocrysts of broken sanidine, oligoclase, nd euhedral smoky quartz compose 25 to 35 percent of the rock; lithic fragments are common; maximum thickness in map area is approximately 300 ft northeast of Mimgray to pink, crystal-rich ash-flow tuff with abundant lithic fragments; the tuff is 40–75 ft thick and has been recognized only on the Cobre uplift, although some thin tuffs in fault blocks in the Mimbres Valley may be correlative; Rustler Canyon Basal approximately 50 ft thick, present only on the Cobre uplift atite-porphyry flows and breccia - Medium-gray, pale-reddish-gray to pale-tan to pale-purplish-gray, intermediate-composition lavas and breccias; most are con-spicuously porphyritic, containing andesine and hornblende phenocrysts 2 - 4 mm long; nonvesicular; flows are locally underlain, interbedded with, and overlain by rhyolitic tuffs and fanglomerate (T4t, T4s), but locally may grade down into the Peak where, however, it may include T4a; between Middle and North Percha Can-H.L., 1954, Geology and mineral deposits of Lake Valley quadrangle, Grant, Luna, and Sierra Counties, New Mexico: New Mexico Bureau of Mines and Mineral Resources, Bull. 37, 93 p.
Kelley, V.C. and Silver, C., 1952, Geology of the Caballo Mountains: University ntermediate-composition lavas and breccia-Propylitized purple, greenish-gray and dark-reddish-gray andesitic to latitic lavas and laharic breccia unconformably overlying Kneeling Nun Tuff and older rocks north and south of Kingston Ranger Sta tion in the east-central Black Range; phenocrysts are common and the unit great resembles Rubio Peak Formation but contains blocks and cobble conglomerates of (neeling Nun Tuff; unit grades (?) up into and is overlain by lighter colored por phyritic lavas (T4lp); T4a is up to 500 ft thick south of Kingston Ranger Station

Rhyolitic intrusives, undivided — Generally massive to slightly flow-banded, aphyric to slightly porphyritic rhyolitic sills, dikes and small plugs; many probably are coeval **DESCRIPTION OF ROCK UNITS** with Mimbres Peak Formation, but some may be as young as early Miocene limbres Peak Formation, tuffs and epiclastic strata—Light-colored, rhyolitic airfall tuffs and breccia, minor ash-flow tuffs, and fluvial to laharic, tuffaceous sandstones, conglomerate, and mudstone, up to 800 ft thick; represents moat deposits of Red to tan eolian sand dunes - Up to 15 ft high on the La Mesa surface overlying Mimbres Peak Formation, flow-banded rhyolite - Pink, gray, tan, platy to dense Undifferentiated deposits - Qvy and Qvo flow-banded rhyolite as domes and flows related to ring-fracture zone of the Emory cauldron; 32.7 ± 1.0 m.y. Desposits associated with latest Pleistocene and Holocene entrenchment and backfilling of Rio Grande and Mimbres Valleys—Qvy—Arroyo-channel, ter-Rhyolite porphyry intrusives associated with Kneeling Nun Tuff — Light-gray to tan, massive to flow-banded rhyolite porphyry that intrudes the Kneeling Nun as race, and fan deposits, mainly sand with pebble- to boulder-gravel zones and some plugs, dikes, and funnel-shaped masses, especially along major faults; mineralogy is nearly identical with Kneeling Nun Tuff—approximately 35-50 percent broken oam to clay; nonindurated; Ω vy $\mathfrak{f}-R$ io Grande and Mimbres floodplain and channel deposits, mostly clay to sand on the Rio Grande, sand and gravel on the Mimbres; crystals of sanidine, oligoclase, and quartz; the sanidine is distinctively chatoyant; 34.7 \pm 0.8 m.y. 33.3 \pm 1.2 m.y., 35.7 \pm 1.2 m.y. Late Pleistocene river, arroyo, fan, and erosion-surface veneers associated Cauldron-breccia facies of Kneeling Nun Tuff-Clasts of Paleozoic limestone with graded surfaces formed during at least two major episodes of entrenchment and partial backfilling of the Rio Grande and Mimbres shale, and sandstone, and Rubio Peak Formation from cobbles to blocks 300ft long embedded in Kneeling Nun Tuff; breccias were emplaced through landsliding of cauldron walls or brought up from depth by intrusion of tuff; locally the breccia is in layers tens to hundreds of feet thick that are concordant with foliation of the tuff; clay in upper few feet; river deposits, well-rounded gravel, and sand, form bluffs and elsewhere blocks are isolated and apparently random within the tuff Kneeling Nun Tuff-Grayish-red to pinkish-brown, crystal-rich, compositionally zoned ash-flow tuff up to 3,000 ft thick within the Emory cauldron and generally less than 450 ft thick in outflow sheets; compound cooling unit; up to 40 percent Deposits associated with latest Pleistocene and Holocene surfaces graded to closed-basin floors - Qpy - Unconsolidated sand, gravel, and loamy sediments of modern drainageways that cross and are inset below or bury older fan surfaces, and sediments of modern fans constructed on basin floors at the end of such Bell Top Formation, undivided and Macho) where those streams have not been entrenched appreciably in a major Bell Top Formation, sedimentary rocks and tuffs-White, tan, and gray, tuffaceous sandstone, mudstone, and conglomerate and rhyolitic air-fall tuff interbedded between tuffs 5 and 6 and between tuff 6 and Uvas Basaltic Andesite basin floor; Qbf -- undissected basin-floor sediments, mostly loam, silt or clay that may be slightly gravelly ranging from Holocene to late Pleistocene; QI – deposits of small playas, mostly clay and silt; all units are generally less than 50 ft thick Bell Top Formation, tuff 6-Densely welded, grayish-red, crystal-rich ash-flow tuff up to 100 ft thick (36.5 ± 1.4 m.y.); simple cooling unit Late Pleistocene fan and terrace deposits and erosion-surface veneers Bell Top Formation, tuff 5-Porous to densely welded, grayish-pink, crystal-rich graded to closed-basin floors-Mostly weakly consolidated gravel and sandy ash-flow tuff with abundant white pumice fragments; up to 300 ft thick (35.1 \pm 1.3 ravel cemented in upper part by soil carbonate or clay; moderate to strong soil development is almost always present in upper few ft; generally less than 25 ft thick Bell Top Formation, flow-banded rhyolite - Pink to gray to tan, crystal-poor, flow-Late Pleistocene axial river deposits of major streams (Mimbres, San Vicente, Macho) that are graded to closed-basin floors—*Mostly gravel and sand* rude lower units of lower member of Bell Top and are unconformably overlain by grading to gravelly silt where streams empty onto basin floors; moderate to strong carbonate or clayey soils cement upper part of deposits Bell Top Formation, lower unit—In ascending order includes 1) tuff 2, a crystal-poor, ash-flow tuff sheet up to 90 ft thick—a simple cooling unit (39.4 \pm 1.5 m.y.), 2) basalt intrusives and flows up to 150 ft thick, 3) tuff 3, a pumiceous ash-flow tuff up Axial river deposits of Mimbres River-San Vicente Arroyo confluence area-Moderately cemented, appreciably older than the general Qpo-Qao-Qbf unit but inset below middle Pleistocene Q1p; deposits are tightly cemented in the upper 3 - 4 to 300 ft thick—a simple cooling unit (29.2 \pm 1.2 m.y., 33.4 \pm 1.3 m.y., 37.6 \pm 1.6 m.y.), 4) rhyolitic air-fall tuff, breccia and epiclastic rocks related to Cedar Hills vents, up to 800 ft thick, 5) tuff 4, a grayish-red-purple, vitric-crystal ash-flow tuff up to 180 Boulder- to cobble-fan deposits and erosion-surface veneers-Near mountain ft thick-a simple cooling unit fronts grading to gravelly silt, loam, or clay on piedmont toeslopes; weakly to moderately cemented; surficial layers usually contain pedogenic calcrete up to 5 ft Sugarlump Formation—Interbedded, rhyolitic, epiclastic strata, air-fall tuff and densely welded, crystal ash-flow tuff sheets (simple cooling units); formation interof the Camp Rice Formation, the former term used west of the western boundary of ancestral Rio Grande drainage, the latter term used for similar piedmont-slope fingers with and overlies Rubio Peak Formation in Mimbres fault block; lithic fragments are largely Rubio Peak lavas; the formation is best displayed at City of deposits within the ancestral Rio Grande drainage area; Q1p is generally exposed only near mountain fronts or in rock-defended positions; generally less than 50 ft thick Rocks State Park and in White Rock Canyon (south end of Black Range); up to 1,400 ft thick; 37.7 m.y. and 36.9 ± 1.5 m.y. Latest Tertiary to middle Pleistocene piedmont deposits, undifferentiated-Intermediate-composition intrusives - Medium- to greenish-gray granodiorite porgenerally includes Q1p deposits as wellLas underlying, well-cemented fanglomera phyry forms the Cooke's Range stock and sills (38.8 ± 1.4 m.y.); similar porphyry variously described as quartz monzonite, andesite, and diorite porphyry forms extenat may date to late Pliocene; correlative with QTcu of the Camp Rice Formation; sive sills within Paleozoic strata along the eastern slopes of the Blank Range; this may be an intrusive phase of the Rubio Peak Formation; smaller semiconcordant masses of similar porphyry also crop out in the Animas Mountains south of Hillsboro where Camp Rice Formation, sediments of La Mesa surface - Basin-center sediments they are overlain unconformably by upper Oligocene-Miocene lavas associated with middle Pleistocene La Mesa surface; generally sand, silt, loam, and clay cemented with pedogenic carbonate and overlain by Holocene dune sand or, Palm Park Formation - Mostly purple, red, and gray, fine- to medium-grained locally, late Pleistocene to Holocene playa or alluvial-flat deposits; up to 50 ft thick om volcanic rocks of intermediate composition; freshwater, lacustrine, and spring Camp Rice Formation, piedmont-slope facies — Deposits associated with Pleistocene piedmont slopes graded to the La Mesa surface; weakly to moderately generally about 2,000 ft thick but thinning to 100 ft or less where the formation buri cemented boulder-to-cobble fan deposits and erosion-surface veneers near mountain hills of Paleozoic, Mesozoic, and Precambrian rocks deformed during the Laramide; fronts becoming gravelly silt, loam, or clay on piedmont toeslopes; surficial layer radiometric dates: 51 m.y., 43 m.y., 42 m.y. usually contain pedogenic calcrete up to 5 ft thick, or, in some cases, thick B soil Rubio Peak Formation - Dark-colored, porphyritic to nonporphyritic, intermedia horizons of red clay; generally less than 50 ft thick (see Q1p for correlation with Qcp) composition lavas ranging from latite to basaltic andesite; interbedded with tuffs, sandstone, conglomerate, and laharic breccia; unit includes some intrusives in form of plugs and dome-flow complexes; radiometric dates are: 44.7 \pm 1.9 m.y., 38.0 \pm 1.5 m.y., 38.0 \pm 1.9 m.y., 37.6 \pm 2.0 m.y., 37.3 \pm 2.3 m.y., 36.7 \pm 2.3 m.y., 32.6 sandstone and conglomerate, gray, green, or red loam to clay, and minor volcanicash lenses, all form tongues of ancestral Rio Grande deposits; locally intertongues with QTcc and piedmont-toeslope deposits of Qcp; up to 300 ft thick 2.1 m.v.: Macho Andesite of Jicha (1954) (40.7 ± 1.4 m.y.) also is included in Rubio Peak Formation; the Rubio Peak is correlative with the Palm Park Formation of Sierra de las Uvas-Caballo area; the formation is up to 3,000 ft thick but only 2,000 or fewer ft thick over most of the Black Range-Cooke's Range area, thinning locally to a Camp Rice Formation, fanglomerate facies-Indurated, calcite-cemented, Qcf; locally contains basalt flows dated 3.1 \pm 0.07 m.y.; up to 300 ft thick few hundred feet or less over Laramide structures Starvation Draw Member of Rubio Peak Formation (Cooke's Range) -Basalt flows, dikes, and plugs-Black to dark-gray, vesicular to amygdaloidal, alkali Generally correlative with Love Ranch Formation of Caballo Mountains; consists of limestone-granite boulder conglomerate, red, gray, and brown sandstone and silty olivine- basalt flows up to 100 ft thick; many flows contain xenocrysts and xenoliths shale derived from Precambrian, Paleozoic, and Mesozoic rocks; andesitic debris is present in the upper part of the unit, and the sandstones contain abundant volcanic upper parts of TQp; radiometric dates: 4.52 \pm 1.0 m.y., 4.22 \pm 0.09 m.y., 3.1 \pm plagioclase, especially in the upper part; unit grades upward into Rubio Peak Forma-tion and is at least several hundred feet thick Op Pliocene-Pleistocene fanglomerate and grayel—Pink, tan to greenish-gray fanglomerate, conglomeratic sandstone, gravel, and gravelly sand in piedmont slopes southwest of Cooke's Range and in the Palomas Basin; in the Palomas Basin the unit ove Ranch Formation - Reddish-brown, boulder conglomerate consisting mostly of limestone and Precambrian granite clasts and lesser andesitic debris; arkose, with the Camp Rice Formation) to Pliocene along the western margin of the basin downward with McRae Formation and upward with Palm Park Formation in the Join been recognized except along the western edge of the basin where thin erosic older unit down to the Precambrian; 0 to 1,000 or more ft thick map unit; downslope, Q1p deposits appear to be conformable on older TQp strata McRae Formation-Interbedded, gray to tan, feldspathic sandstone and conglomerate, and reddish or purplish-gray shale and siltstone; the unconformable base is marked by 50-100 ft of boulder conglomerate derived from porphyritic, Gila Group—Light-brown, poorly stratified fanglomerate and conglomeratic sandstone largely derived from volcanic rocks in the Black Range; weakly to well-cemented; mapped only in Mimbres Valley and southern Black Range-Cooke's Range area (outintermediate-composition lavas or intrusive rocks; occasionally, red-brown Love Ranch conglomerate tongues are interbedded in the formation; only a few hundred side the Rio Grande drainage); dated basalt flows near the base and top indicate deposition between 20 and 6 m.y. ago; up to 1,000 or more ft thick feet thick east of the Caballo Mountains; the formation thickens northward to 1,000 or more ft near Elephant Butte termediate-composition intrusives - Equigranular, medium-grained diorite and ing xenocrysts and mantle and lower-crustal xenoliths; interbedded with Rincon monzodiorite stock in North Percha Creek and border facies of the Warm Springs Valley Formation in Cedar Hills and within upper Gila Group in Mimbres Valley; up to 200 ft thick; 9.3 m.y., 9.8 \pm 0.3 m.y., 6.3 \pm 0.4 m.y. anyon stock; sill of quartz diorite within Pennsylvanian strata in the Cobre uplift Silicic intrusives - Light-gray, equigranular to porphyritic quartz monzonite of the Santa Fe Group, Rincon Valley Formation, playa facies - Pale-red claystone, siltstone. locally gypsiferous, that accumulated in alluvial flats and playas near stock in Warm Springs Canyon, 1 mi northeast of Hillsboro; quartz veining and pyrite centers of early rift basins; grades laterally to Tsrc; up to 2,000 ft thick fanglomerate, conglomeratic sandstone, and pinkish mudstone largely derived fro limestone in the Caballo Mountains and from volcanic rocks in the Sierra de las Uv. and eastern Black Range; the formation overlaps all older units along margins of ertiary uplifts but overlies older Santa Fe basin fill in the late Tertiary basins; contact with older Santa Fe units locally is an angular unconformity; up to 1,000 ft thick in Santa Fe Group, Hayner Ranch Formation—Brown, purplish-brown, and red limestone tongues; mostly derived from local volcanic rocks; locally siliceous and containing veins of barite and psilomelane; up to 3,000 ft thick in early rift basins Santa Fe Group, upper part of Thurman Formation - White to light-gray, parallel bedded, tuffaceous, lithic sandstone and pink mudstone overlying Uvas Basaltic Caballo Mountains; up to 1,300 ft thick; lower Thurman sedimentary rocks (Kelley akota Sandstone - White to pale-orange and tan siltstone and sandstone, some relative with Bell Top Formation and were mapped as Bell Top. Upper Thurman strata Mexico and are probably a basin facies of Coyote Canyon fanglomerate member of Rhyolite flows and domes, tuffs and breccia, undivided -T3,4r-rhyolite flows and domes correlative with Tmr and/or T4r; T3,4t-rhyolitic tuffs correlative with T4t and/or Tmt; T3,4br-rhyolitic to latitic breccias in Cold Springs Canyon (west of Sawyers Peak) correlative with T4r and/or Tmr or slightly to moderately porphyritic; also rhyolitic, tuffaceous sedimentary rocks, air-fall tuff, breccia, and minor basaltic andesite; unit includes Swartz Rhyolite (26.6 \pm 0.6 n.v.) of Elston (1956): sedimentary rocks in the unit may be early Gila strata as young as 20 m.y.; unit overlies T4ba or T4lp at southern end of Black Range but where hese dark-colored lavas are absent, the younger rhyolites may overlie similar rhyolite and tuff of the Mimbres Peak Formation (as in the southwestern Black Range); in Caballo Mountains; unit has been eroded elsewhere eso Formation — Gypsum and tan, pale-red to white sandstone with lesser amounts ogether as T3,4r or T3,4t; younger rhyolites are at least 1,000 ft thick west of Coyote Canyon Member of Uvas Basaltic Andesite - Brown fanglomerate and

Andesitic rocks near Copper Flat—Dark-gray to greenish-gray, andesitic-lava flows and laharic breccia northeast of Hillsboro; flows are either domed up above the Cop per Flat stock or form the flanks of a stratovolcano; propylitic alteration is extensive and mineralized veins and quartz-latite dikes radially cut the andesites Mesaverde Formation - Interbedded, olive-gray shale and massive, buff to tan, lenticular sandstone, siltstone, and conglomerate, mostly nonmarine except transitional downward into the marine Mancos; coal is present locally; probably 2,500 or more ft thick in the Caballo Mountains, eroded elsewhere Mancos Shale — Gray, fissile, calcareous marine shale containing 1-4-inch-thick lime stone beds in the lower part and silty, olive-gray shale and siltstone in the upper part fossiliferous; 350–450 ft thick in the Caballo Mountains

beds of which are quartzitic; minor conglomerate and gray shale are present; lower part of the unit may contain some beds correlative with the Sarten-Beartooth; approximately 255 ft thick in the Caballo Mountains Colorado Shale - Dark-gray to black, blocky shale with thin interbeds of buff sandstone, sandy shale, and dark-gray limestone; correlative with part of Mancos Shale of the Caballo area: approximately 170 ft thick in the Cooke's Range

Sarten Sandstone and Beartooth Quartzite—Light-gray, massive quartzitic sand stone with minor black shale and conglomerate locally; 50–140 ft thick in the Cobre uplift, 300 ft thick in the Cooke's Range Yeso Formation and San Andres Limestone, undivided San Andres Limestone - Thin to medium-bedded, light to medium-gray limestone, slightly dolomitic in places; lenticular beds of yellow sandstone and lesser gypsum oc-casionally are interbedded; fossiliferous; thickness is 550 to nearly 1,000 ft in the

> of siltstone, limestone, and claystone; approximately 400-600 ft thick in the Caballo Mountains, eroded elsewhere Abo Formation — Reddish-brown to light-brown sandstone interbedded with grayish red shale, claystone, and siltstone; some chert-pebble conglomerate beds are conspicuous and some clastic beds contain gray nodular limestone, especially in th western part of the map area; correlative with Lobo Formation of the Co a: thickness ranges from 0 to 200 ft in the Cobre uplift, to approximately 400 ft in the Black Range, to 550-1,000 ft in the Caballo Mountains Lobo Formation (of Cooke's Range) - Reddish-brown sandstone and shale, chertpebble conglomerate, and minor, interbedded, nodular limestone; correlative with Abo Formation of Black Range and Caballo Mountains; 80–300 ft thick

ennsylvanian rocks including Syrena and Oswaldo Formations and Magd mediate-colored flows of vesicular basaltic andesite and generally nonvesicular latit and andesite with minor interbedded rhyolitic tuffs; generally correlative with Tu lena Group - Lower unit of transgressive, thin-bedded limestone, shale, sandstone, Tra and Tbsp and locally may intertongue with and include T4lp; up to 1,000 ft thick in the Animas Mountains; one flow west of Hillsboro is 28.1 ± 0.6 m.y. old conglomeratic sandstone, and cherty, massive limestone grading up into a medial unit of massive, fossiliferous, gray limestone and interbedded shale; upper parts of the system generally are regressive, consisting of soft, argillaced limestone and calcareous shale with interbedded limestone ledges, all highly olugs in Animas Mountains and Sierra de las Uvas; correlative with Tbsp, Tu and fossiliferous: white chert breccia derived from the Lake Valley Formation marks th base of the Pennsylvanian in many places; total thickness varies from 185 ft in ke's Range to 500-800 ft in the Cobre uplift, to 700 ft in the Black Range, to 1,000-1,500 ft in the Caballo Mountains Devonian and Mississippian rocks

azorback Formation — Black to dark-gray, nonporphyritic andesite flows stained re Caballero and Lake Valley Formations-The Caballero is greenish-brown calalong fractures by hematite; many flows exhibit platy flow layering and most are onvesicular; sparse phenocrysts are fine-grained andesine-labradorite; near Mim not been recognized in the Cobre uplift or in the central Caballo Mountains; in the bres Hot Springs and on the Cobre uplift, andesites are overlain by dark-colored, fine-grained to glassy siliceous flows, also part of the Razorback; spherulites are common locally in these flows; total maximum thickness is approximately 800 ft lack Range-Cooke's Range area and southern Caballo Mountains it is 36-70 ft thick he Lake Valley Formation consists in ascending order of 1) a basal, slope-forming oft, light-gray limestone and marl unit with abundant fossils, 2) prominent ledge forming, medium-blue-gray, aphanitic limestone ranging from 10 to 50 ft in thickness 3) slope-forming, soft, highly fossiliferous limestone and marl, and 4) an upper unit of Rhyolitic tuffs-White, rhyolitic air-fall tuff and breccia locally beneath and interbedded with Tra, T4lp, Tbsp and T4ba; interbedded T4t units were not mapped nick-bedded limestone containing abundant white chert: the upper unit is missing the Caballo Mountains; total thickness ranges from 300 to 400 ft in the Cobre upli Conglomerate, sandstone, and shale—Generally correlative with Piloncillo sedi-0 to 225 ft in the Black Range-Lake Valley area, and 0 to 65 ft in the Caballo Mounments of Elston (1956); light-brown to dark-gray, crossbedded sandstone, fluvial contains; 450 ft thick in the Cooke's Range Percha Shale — Dark-gray to greenish-gray, fissile shale with lesser calcareous siltstone and nodular limestone; 230–315 ft thick in the Cobre uplift, 110–130 ft thick in the Hillsboro the unit includes thick brown shale and siltstone strata in

Black Range, 200 ft thick at Lake Valley, and 10-180 ft thick in the Caballo Mountains Montoya Group and Fusselman Dolomite - The Montoya (Ordovician) is light- to dark-gray, thick- to thin-bedded dolomite that contains a basal sandy zone and a bres fault block, 205-400 ft thick in the Black Range-Lake Valley area, 320 ft thick in the Cooke's Range, and 280-440 ft thick in the Caballo Mountains; the Fusselman Dolomite (Silurian) consists of light-gray to pale-grayish-orange, massive dolomite; locally there is abundant brown-weathering chert but elsewhere chert is sparse; 100-300 ft thick in the Cooke's Range and 0-100 ft thick in the Caballo Mountains Bliss Sandstone and El Paso Group-The Bliss (Cambrian-Ordovician) consists of greenish-gray, dark-brown, and purplish-black hematitic and glauconitic sandstone shale, and quartzite; 140-188 ft thick in the Cobre uplift, 110-130 ft thick in the Black Range, 95 ft thick in the Cooke's Range, and approximately 135 ft thick in the Caballo Mountains; the El Paso (Ordovician) consists of thin- to medium-bedded, light- to medium-gray limestone and dolomite, much of which contains brow

weathering, siliceous laminae and irregular, twig-shaped burrows; approximately 50 415 ft thick in the Caballo Mountains Massive granite — Pink to red massive granite, except in the east-central Black Range where gneiss, hornblende, chlorite schist, and amphibolite compose the Precambrian

SYMBOLS (continued under Tectonic map)

. normal fault, ball on downthrown side; dashed where inferred, dotted where buried; arrow shows direction and amount of dip thrust or reverse fault, barbs on upthrown side

anticlinal axis, showing trace of axial plane and direction of plunge monoclinal axis, showing trace of axial plane and direction of plunge synclinal axis, showing trace of axial plane and direction of plunge axis of overturned anticline axis of overturned syncline

strike and dip of bedding or lava flows landslides strike and dip of overturned beds

1 ½ 0 1 2 3 4 5 6 7 8 9 Miles 1 0 1 2 3 4 5 6 Kilometers 1982

MEXICO TEXAS 109° 108° 107° 106° 105° 104° 103°

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district, Grant County, New Mexico – the San Lorenzo area: M.S. thesis,

Pollack Quartz Latite - Pinkish-brown, light-red to pale-purple porphyry containing tals of quartz, hornblende, and biotite; occurs in a limited area adjacent to